

Claims

1. A method of detecting and showing variations in the number and/or the morphology of the skin lesions of dermatological interest, characterized in that in order to automate the detection and the transmission of said variations digital images of the body surface of the tested subject are collected after having divided the latter into one or more areas exactly located by means of spatial coordinates in a system of coordinated axes fixed with respect to predetermined unchanged reference points of the subject, the images being stored in a suitable data base to be then compared automatically with corresponding images collected at distance of time, thus producing a signal of any variation in the number and/or the morphology/colour of the lesions.

2. The method according to the preceding claim, characterized in that there are provided the following operating steps:

- 20 A. subdividing the body surface into quadrants with suitable size;
- B. selecting predetermined reference or "repere" anatomic points so that the following detection may have repere points able to collimate the body quadrants of the same subject;
- C. collecting and storing images with high definition relative to the above-mentioned quadrants;
- D. processing the stored images to perform the

following operations:

- locating, numbering and measuring all of the skin lesions present in each quadrant;
- storing images and data relative to said skin lesions;
- if the subject is not a new subject, comparing collected images and corresponding data with previously stored images and data of the same subject;
- highlighting and/or transmitting the new skin lesions in each quadrant and/or highlighting the morphological/colorimetric variations in one or more previously located skin lesions;
- storing data relative to the detected differences.

15 3. The method according to claim 1, characterized in that there are provided the following steps:

- a) inputting anthropometrical data of the subject to be tested;
- b) selecting the portion(s) of the body surface to be detected;
- c) positioning the subject on the basis of the predetermined reference and/or repere points
- d) calculating the coordinates of the centre of each image and the direction of collection of each of them;
- e) collecting and storing said images automatically and repeatedly;
- f) analysing the stored images to locate the existing skin lesions of interest;
- g) comparing the analysed images with the images stored and analysed previously, if any, to highlight

the presence of any numeric and/or colorimetric difference.

4. The method according to claim 2 or 3, characterized in that said processing or analysis of the stored images provides essentially:

- locating objects contained in the image other than skin (underwear, background, etc.);
- locating structures that can produce false positives (hairs, spots produced by natural orifices or shadows, tattoos, etc.); and
- locating lesions of interest to be compared and ignoring objects and/or structures of the two preceding items.

15

5. The method according to any preceding claim, characterized in that in order for any variation of the collected images not relating the state of the skin lesions to be suppressed or minimized, it is provided that each skin portion of the same subject is detected in subsequent times from a predetermined and fixed point of view, or that the spatial positions of the detection apparatus and the tested subject (or his/her skin portion) are constant.

20

6. The method according to the preceding claim, characterized in that the tested subject is allowed to sit down to essentially the same position in any test following the first.

25

30

7. The method according to claim 5, characterized in that the segmentation of the body into images is performed so that the edges of the images are partially overlapped so as to allow a comparison even when modifications of the body of the tested subject take place between subsequent tests.

8. The method according to the preceding claim, characterized in that the number of collected images for a determined patient is always the same, even if the patient increases in weight and/or height in time.

9. The method according to any preceding claim, characterized in that the patient is illuminated uniformly and from different angles so as to avoid portions in the shade at the areas to be detected.

10. The method according to claim 3, characterized in that step f) of image analysis includes the following steps:

- recognizing not human pixels;
- ablating piliferous appendages by parametrization software;
- constructing grey levels referred to the weight of blue;
- constructing the background (smoothing);
- constructing levels of identification of the pigmented areas (spot objects);
- calculating mathematically the evidence threshold;
- recognizing the pigmented areas (spot objects);

- characterizing the pigmented areas in terms of their specific qualities (spot objects);
- differentiating the pigmented areas (spot objects) of the background noise (hair, underwear, tattoos, orifices, etc. objects).

5 11. The method according to claim 3, characterized in that step g) of image comparison includes the following steps:

- 10 - collimating frames (algorithm 1);
- rotating/translating in scale;
- calculating the known connections;
- translating the pigmented areas (spot objects) to an assigned range to minimize the discards;
- 15 - calculating the differences (minus and/or plus dimensional - variation of the inner colour);
- optimising: if the number of erroneous connections is greater than three or if the secondary translation of the pigmented areas (spot objects) is greater than 20 an assigned level (for example 100 pixels), a second collimation method (algorithm 2) is performed.

25 12. An apparatus for detecting images by the method according to the preceding claims, characterized in that there is provided in combination:

- a) an application software for processing fine graphic data (skin lesions) provided with algorithms able to provide a discrete set of the detected images (matrices of calculation);
- 30 b) a data base for the statistic analysis of data of

- interest;
- c) a data processing portion for clinic, personal data of the subjects for storing and listing the images of each patient upon his/her visiting (mode of the case history);
- d) a reference surface provided with anthropometrical references with respect to which the tested subject is positioned;
- e) means for lighting uniformly without shadows the zones of the subject body surface to be detected;
- f) image collection means;
- g) means for supporting and/or driving under control such image collection means with respect to the patient;
- h) interface means for controlling the data collection and transmission to suitable storing and/or processing means;
- i) at least a computer connected to such interface means;
- j) at least a high definition monitor or video or other display means of the known type;
- k) means for controlling the correct repositioning of the subject.
- 25 13. The apparatus according to the preceding claim, characterized in that said anthropometrical references located in the reference surface for positioning the subject are able to locate the repere points which are significant for different somatic types as well as for

the same patient subjected to several next detections so that defined, significant body areas that can be overlapped are obtained to guarantee a correct collimation of the collected images.

5

14. The apparatus according to the preceding claim, characterized in that it is controlled and managed in a completely automatic way by a computer controlled by an assistant.

10

15. The apparatus according to claim 12, characterized in that said support and drive means of the image collection means is able to position the latter perpendicular to the area of the body surface to be detected and at a constant distance therefrom.

15

16. The apparatus according to claim 12, characterized in that the position and the orientation taken by said image collection means for each collected image are stored during the first session so that corresponding images are collected in the following sessions exactly with the same position and orientation, thus providing following images perfectly corresponding and comparable with those of the preceding session.

20

17. The apparatus according to claim 12, characterized in that the positions of the images to be collected are calculated so that the edges of images adjacent to one another are partially surmounted, thus forming an overlap.

25

30

18. The apparatus according to the preceding claim,
characterized in that the overlap of the image edges
adjacent to one another varies preferably from a
maximum equal to half the height and half the width of
the image to a minimum that can be zero (images with
coincident edges).